Oregon

Challenge Cost-Share Agreement
No. 00-CS-11061600-28

Habitat Prediction Mapping for Three Rare Plants on the Wallowa-Whitman National Forest:

Mirabilis macfarlanei
Silene spaldingii
Spiranthes diluvialis

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In the mutual interest of both the Oregon Natural Heritage Program and the Wallowa-Whitman National Forest (WWNF), this project was created to better understand the distribution of three rare plants. *Mirabilis macfarlanei* (Mac Farlane's Four-o'clock) is a federally listed Threatened species which is found in Oregon's Snake and Imnaha River Canyons. *Silene spaldingii* (Spalding's Catchfly) is proposed for listing and is found along the margins of the Wallowa Valley. *Spiranthes diluvialis* (Ute's lady's-tresses) is also a listed Threatened species. It is not known to occur in Oregon, however, similar habitat to known populations may exist on the WWNF.

METHODS

Mirabilis macfarlanei (MIMA) and *Silene spaldingii* (SISP)

To identify potential habitat, we examined existing documentation of occurrences. The Natural Heritage Programs of Washington, Montana, Idaho, and Oregon provided this information which included locations, habitat parameters, and associated flora. This data was supplemented with digital maps of known population distribution for analysis with a geographic information system (GIS).

For each species, we overlaid its distribution map with a map of topography (digital elevation model, 30m resolution) and existing vegetation (WWNF's "EVG" map). A map of soil types may have been useful, but none exists for WWNF. The resulting map overlay attributed each population with a corresponding value for each habitat feature (elevation, slope, aspect, and vegetation type).

This data was then subjected to discriminate analysis for each species using SYSTAT software. From this analysis, we identified the overall relative importance of each habitat feature (Table 1).

Table 1. Relative importance of habitat features as derived by discriminate analysis.

	Relative Importance
***Mirabilis macfarlanei* (MIMA)**	
Vegetation	34%
Elevation	66%
Aspect	-
Slope	-
***Silene spaldingii* (SISP)**	
Vegetation	57%
Elevation	13%
Aspect	-
Slope	30%

Within each habitat feature it was necessary to further distinguish the relative importance of classes (e.g. rank each veg type for potential value as habitat). To do this, each population occurrence was tallied according to each habitat features. For vegetation types, the tallies were converted into percentages. Then a corresponding

value between 0 and 9 was assigned to each veg type in the WWNF map. For topography features, ranges of important values were weighted in a similar fashion. Appendix A provides the rankings used.

A model for each species was executed using ArcView software's ModelBuilder module. The output consisted of a map at 60m resolution.

Spiranthes diluvialis (SPDI)

Predicting habitat for SPDI in Oregon presents some challenges. Unlike the previous modeling approach, there are no known occurrences of the plant on the National Forest or in the neighboring vicinity. The nearest populations are in Washington and Montana at about 220 miles away. Furthermore, several data layers which would be useful for predicting SPDI were not possible to use (Table 2).

Table 2. Data layers applicable to predicting habitat for SPDI on WWNF. Those in **boldface** were used in prediction.

Digital Layer	Source	Status or Quality
WWNF Boundary	**USFS**	**Missing some small private inholdings**
Streams and Rivers	**Streamnet**	**1:100,000 and 1:24,000 scale**
Elevation and Slope	**USGS**	**30m resolution**
Watershed	**USGS**	**Fifth-field Hydrologic Unit**
Avg. Annual Precipitation	**USDA**	**Years 1961-1990**
Vegetation	USFS	Poor quality for riparian/wetlands
Ponds and Lakes	USGS/USFS	Coarse Scale (missing most small ponds)
National Wetlands Inventory	USFWS	Nonexistent for WWNF
Soil	USDA	Nonexistent for WWNF

To help compensate for lack of local data, a comprehensive habitat profile was created based on documentation from all known occurrences in the United States. Data from each state supporting SPDI was collected and summarized (Table 3). These habitat values for the various parameters (i.e. elevation, slope, etc.) were used as inputs for a prediction.

Analysis was limited to riverine corridors (streams and rivers). All known populations of SPDI occur along riparian areas. Only a single occurrence is associated with a lake, but is seasonally flooded similar to riparian zones. All riverine corridors between 720 and 7000 feet above sea level were considered as potential habitat. Average annual precipitation between 7.5 and 22 inches was also a requirement for habitat. Finally, very low stream gradients (0-1%) were selected. Where all these parameters correspond spatially, SPDI habitat was mapped as riverine segments.

Because the total sample size of SPDI occurrences in the Northwest is small, and known populations are widely distributed across different regions, a meaningful ranking approach such as done for the previous models would have little merit. Instead, watersheds (5^{th}-field) have been ranked based on the amount of potential habitat they support. Potential habitat is the calculation of the total length of suitable riverine habitat. This calculation was determined using a final measure of riverine segment length. Thus, segment length serves as the surrogate for quantifying SPDI habitat. A preferred areal quantification would require adequate riparian vegetation mapping which is not available.

However, a crude estimate can be made if all riverine segments are given a uniform width. An arbitrary width of 30m was used and output is provided in results (Table 4).

Table 3. Habitat values used for predicting where SPDI may occur on Wallowa-Whitman NF.

Habitat Parameter	ID	MT	UT	WY	WA	CO	NE	Range
Number of Known Occurrences	22	11	40	1	4	32	2	2-32
Elevation (ft)	4800-5300	4080-4450	4300-7000	5100-5200	720-1830	4500-6240	4590-4630	720-7000
Stream gradient	gentle	low	-	-	0%	-	Low	0-1%
Precipitation (in)	12.5-17.5	9.6	7.5–22.5	14-22	12.5–22.5	12.5-22.5	10-12	7.5–22

RESULTS

Mirabilis macfarlanei and *Silene spaldingii*

Both species were predicted to occur almost exclusively on the northeasternmost portions of the WWNF. *Mirabilis macfarlanei* is most likely to thrive among the bunchgrass- covered steep slopes of Hell's Canyon (Figure 1). There is also moderate quality habitat along the Lower Imnaha River. The total amount of moderate to very high quality habitat is 40,503 acres. In contrast, SISP habitat is estimated to be more widespread. Generous amounts of very high quality habitat are located at Roberts Butte, Powwatka Ridge, Red Ridge, Red Hill, and Triangle Mountain (Figure 2). The total amount of moderate to very high quality habitat is 111,938 acres.

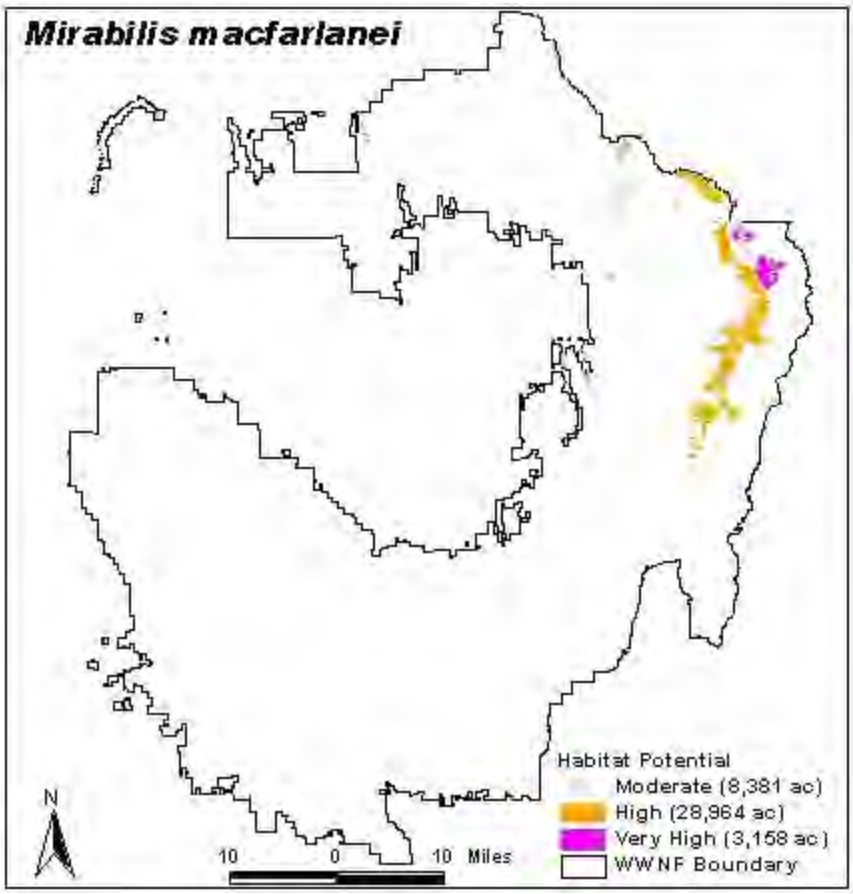


Figure 1. Mapped habitat potential for *Mirabilis macfarlanei*.

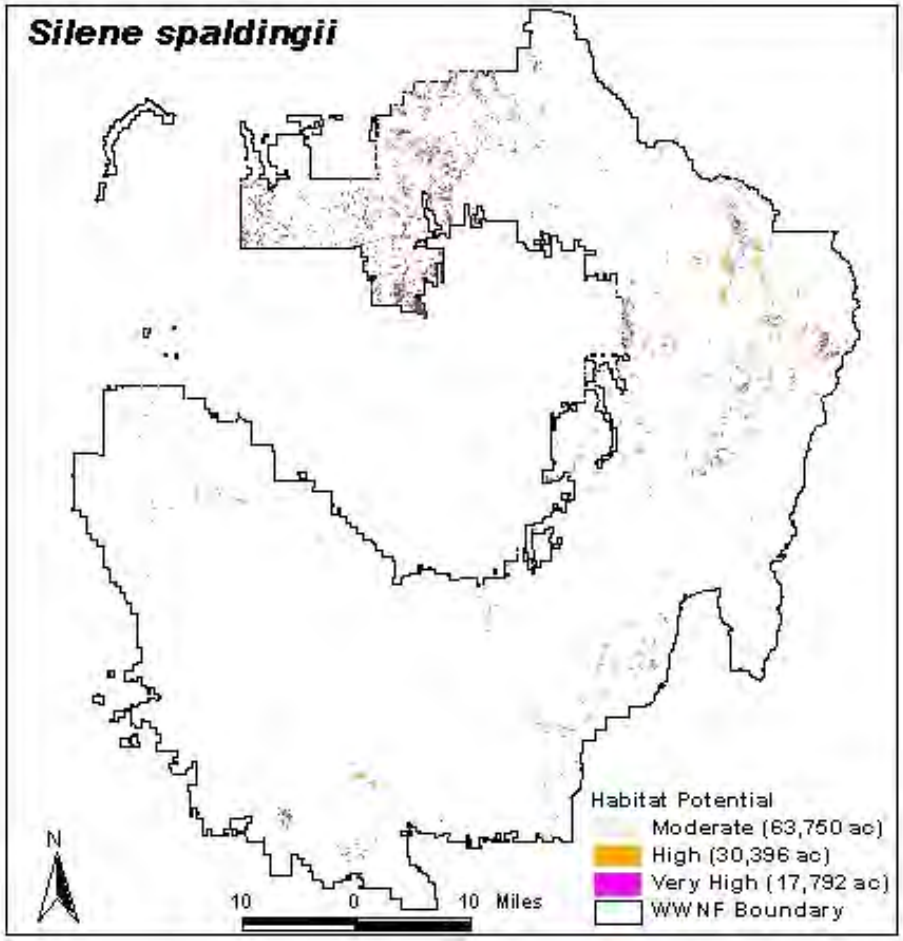


Figure 2. Mapped habitat potential for *Silene spaldingii*.

Spiranthes diluvialis

Most suitable habitat is estimated to be in the southernmost portion of the National Forest (Figure 3). Other areas, such as the Wallowa and Elkhorn Ranges exhibit elevations and precipitation to excessive for SPDI. In contrast, the vicinity around Whitney, OR is especially suitable. In this area, the Burnt River and its tributaries support meandering low-gradient watercourses typically associated with SPDI. However, many of the mapped segments are actually on private land. This ownership delineation was absent from the source data layer for the WWNF boundary. Notwithstanding, nearby publicly owned lands such as Phillips Lake and its feeder streams as well as distant Chesnimnus Creek in the northern part of WWNF are prominently mapped with potential habitat. Portions of the Snake River were also selected. Incidentally, populations are known to occur along eastern Idaho's Snake River (south fork) on islands, alluvial bars, and cottonwood swales.

Although private land was generally avoided in this mapping effort, results which are not included here indicate that a significantly greater amount of potential habitat exists outside of public ownership. The extensive Wallowa and Baker Valleys are well endowed with potential habitat. The likelihood of WWNF supporting SPDI is much less. The sum amount of potential riverine length habitat forest-wide equals 302 miles (487

km). This equates to roughly 3,609 acres (1461 ha) (Table 4). Overall, these results reflect the range-wide tendency for SPDI to be absent from public lands.

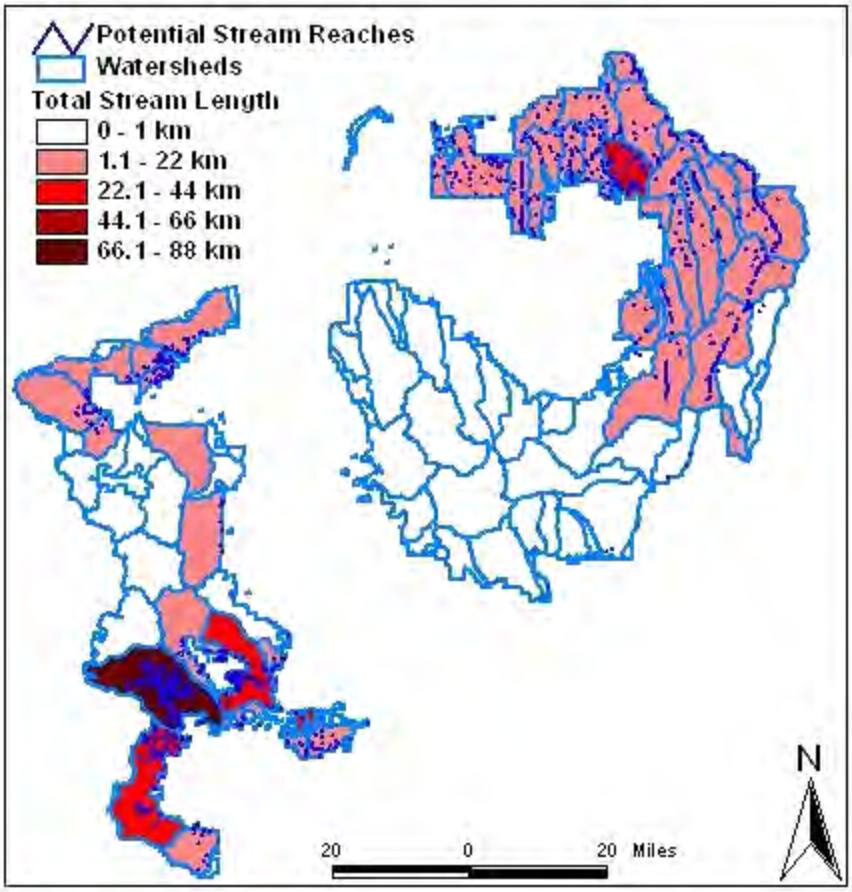


Figure 3. Total suitable riverine segments for SPDI calculated for each watershed.

Table 4. Equivalent area of potential habitat as it relates to riverine segment length (using a uniform 30m wide corridor).

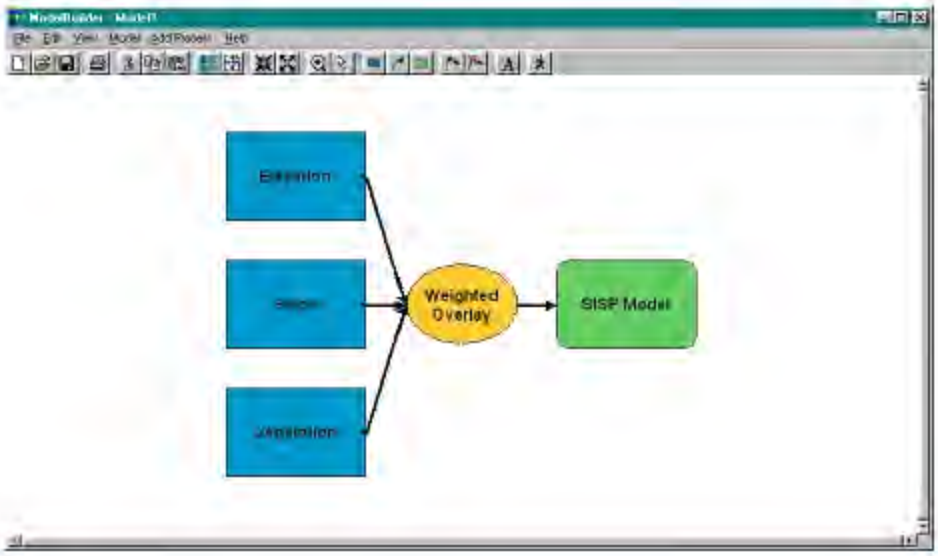
Length Classes (from Figure 3)	Total Area (ac)
0 - 1 km	0 – 6 (0–3 ha)
1.1 - 22 km	6 – 163 (3–66 ha)
22.1 – 44 km	163 – 326 (66-132 ha)
44.1 – 66 km	326 – 489 (132–198 ha)
66.1 – 88 km	489 – 652 (198–264 ha)

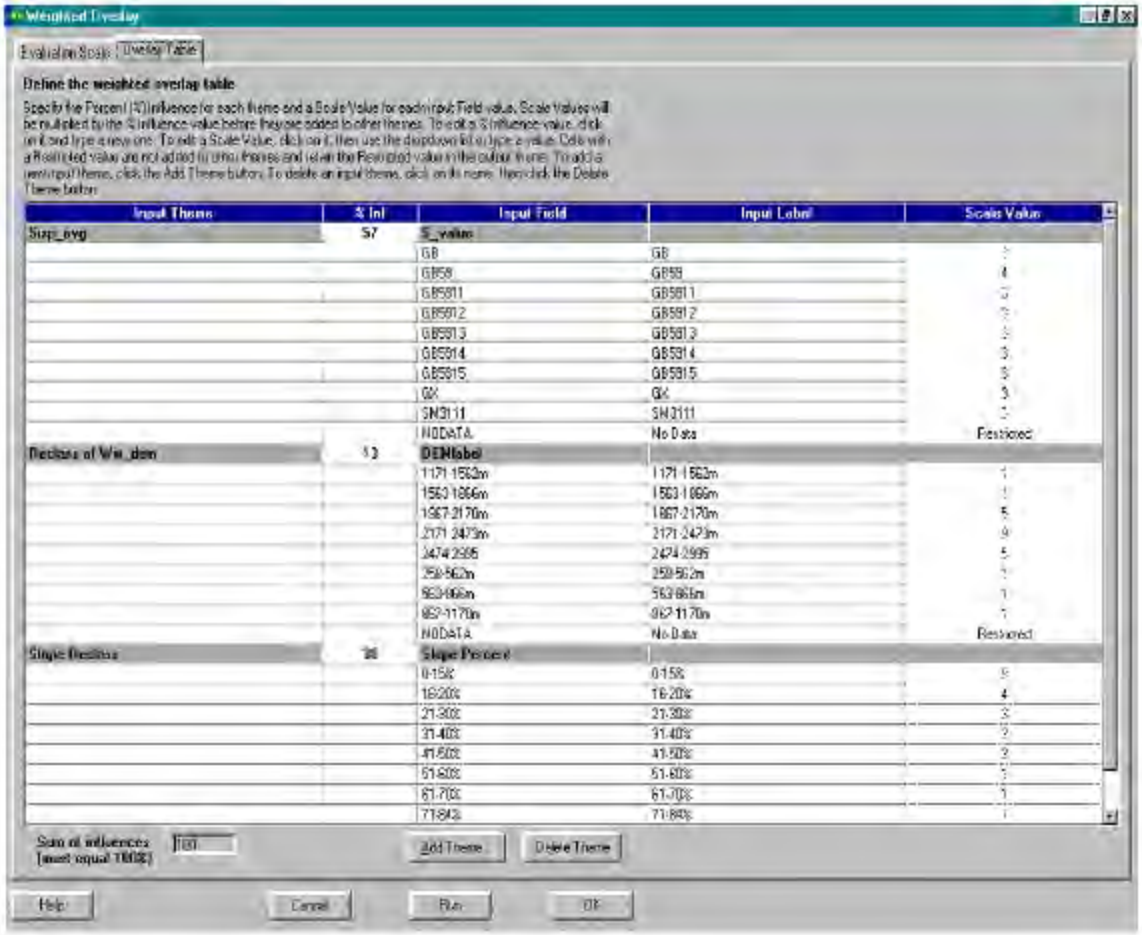
CONCLUSIONS

The distribution and amount of total potential habitat among the three species differs markedly. *Spiranthes diluvialis* habitat is estimated to be very limited and mostly located in the southwestern portion of WWNF. Potential habitat for this species on the National Forest is dwarfed by acreage on adjacent private land where low-gradient meandering streams are much more extensive. Habitat for *Mirabilis macfarlanei* is estimated to be restricted to the Hell's Canyon breaklands and Lower Imnaha River. The total amount of moderate to very high quality habitat is 40,503 acres. *Silene spaldingii* is potentially more widespread on the northeastern portion of WWNF with moderate to high quality habitat approximating 112,000 acres. Additional map information which was unavailable for this analysis, such as accurate wetland vegetation and soil, could be very useful in refining habitat predictions for these rare plants.

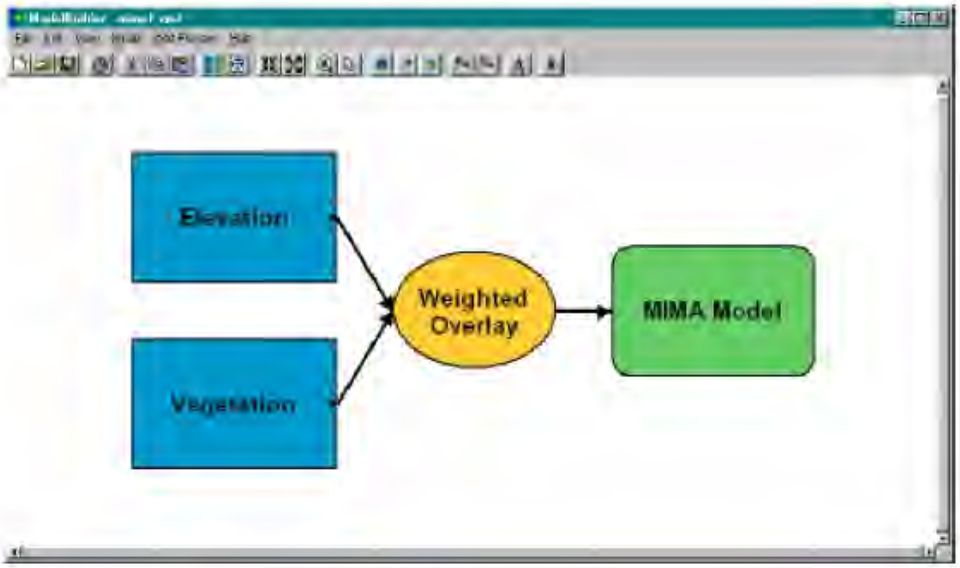
APPENDIX A.
Rankings used for *Mirabilis macfarlanei* and *Silene spaldingii* modeling

SISP model





MIMA model



Weighted Overlay

Evaluation Scale | Overlay Table

Define the weighted overlay table

Specify the Percent (%) Influence for each theme and a Scale Value for each input Field value. Scale Values will be multiplied by the % Influence value before they are added to other themes. To edit a % Influence value, click on it and type a new one. To edit a Scale Value, click on it, then use the dropdown list or type a value. Cells with a Restricted value are not added to other themes and retain the Restricted value in the output theme. To add a new input theme, click the Add Theme button. To delete an input theme, click on its name, then click the Delete Theme button.

Input Theme	% Inf	Input Field	Input Label	Scale Value
Mima_veg	**34**	**S_value**		
		GB	GB	1
		GB1911	GB1911	8
		GB41	GB41	1
		GB4116	GB4116	3
		GB4118	GB4118	3
		GB4912	GB4912	1
		GB4914	GB4914	1
		GX	GX	5
		NODATA	No Data	Restricted
Reclas_ww_dem	**66**	**DEMlabel**		
		1201-1578m	1201-1578m	6
		1579-2995m	1579-2995m	9
		258-371m	258-371m	6
		372-836m	372-836m	3
		837-950m	837-950m	1
		951-1200m	951-1200m	1
		NODATA	No Data	Restricted

Sum of influences (must equal 100%) 100

Add Theme... | Delete Theme

Help | Cancel | Run | OK